

## RATIONALE OF THE SYSTEM OF INDICATORS FOR COMPLEX EVALUATION OF A COMPANY'S FINANCIAL CONDITION VIA CORRELATION ANALYSIS

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**Abstract.** A comprehensive assessment of a company's financial condition and its performance in terms of its economic potential requires a developed system of analytical indicators. At the same time, an interpretation of key trends of the company's development, based on the generalization of arrays of analytical data, becomes more complicated. While justifying the approaches to work out the problem outlined, the authors have advanced an algorithm for conducting and evaluating the results of correlation analysis of financial indicators, formed on the basis financial reporting of the economic entity. The methodical framework advocates measuring the quantitative and qualitative parameters of the correlation relationships between the calculated coefficients. The authors have argued that a thematic study of tightness of correlation characteristics allows to mathematically substantiate the composition of indicators whose dynamics is determined by the impact of homogeneous economic factors. Elimination of duplication in the composition of financial indicators underlies the formation of an individual system of indicators for an integrated assessment of the company's financial condition

**Keywords:** financial ratios, financial indicators, financial condition, financial analysis, integrated assessment, correlation analysis.

**1. Introduction.** Generalization of the approaches presented in specialized literature allows us to conclude that when analyzing the financial standing according to the accounting (financial) reporting data of an economic entity, various financial indicators are used that make it possible to characterize extensively enough its financial and economic activities. However, a significant number of indicators used in the analysis process make it difficult to identify existing patterns and trends in the development of the company. Substantiation of the algorithm for conducting financial analysis aimed at formation of a comprehensive assessment for the financial standing of a company involves selection of the necessary financial indicators and determines applicability of correlation analysis as a tool for solving the task in view.

**2. Methods.** It can be stated with certainty that the issues of assessing the financial standing and results of financial and economic activities of a company are one of the main fundamental areas of economic analysis over a long period of time [2, 9, 10]. There is a significant array of economic indicators through which it is possible to conduct an analysis of financial standing of the company [1]. The information base for determining the financial indicators that are used in the course of analytical estimation is accounting (financial) reporting. It should be noted that the use of various accounting systems has a significant impact on the methodology and results of the study conducted, as well as on the interpretation of economic indicators [3, 4, 7, 11, 6]. Comparative analysis confirms that the differences between Russian and foreign approaches to the analysis of the financial standing of economic entities arise as a result of the use of various information sources, methods for determining indicator systems, and establishing the regulatory values of financial ratios that take into account the specifics of national and industry characteristics of the company [5]. Nevertheless, the positions of the researchers are unanimous in that the overall assessment of the financial standing requires the interpretation of indicators that reflect the full set of results which characterize the activities of an economic entity. In this connection, in modern conditions, much attention is paid to attempts to construct an integral indicator based on the application of economic and mathematical tools [8, 12, 13]. The generalization of the main content of the information sources presented has formed the basis for the author's proposals disclosed in this work concerning the use of correlation analysis tools in assessing the financial standing of the company.

**3. Results.** In this paper, we examined the possibility of applying correlation analysis methods to form an optimal system of financial indicators by the example of one of the largest vertically integrated oil and gas companies in the world which accounts for more than 2% of world oil production and about 1% of proven hydrocarbon reserves, PJSC Oil Company Lukoil. The information source that provided the basis for the study was the publicly available data of the company's consolidated financial statements for the period from 2006 to 2015. A sufficient array of digital data relating to different time periods allows us to describe the basic development trends of the company with the required degree of reliability. At the initial stage of the study, we calculated a number of financial indicators represented in four main groups: financial stability indicators, solvency indicators, turnover indicators, and profitability indicators. The calculation results for the financial indicators of PJSC "Oil Company "Lukoil" for 2007-2015 are presented in Table 1. It should be noted that in determining the financial ratios for combining the moment indicators of the economic status of the company and dynamic performance indicators, the average annual values calculated on the basis of the financial statements were used. It should be noted that the increase in accuracy of the calculations directly depends on the number of reporting dates that are the basis of the study.

The obtained values of financial coefficients became an information field to carry out the correlation analysis realized with the use of computer-aided tools for processing economic information. The results of the correlation matrix

estimation are presented in Table 2 which shows the qualitative and quantitative characteristics of financial indicators and their group and out-group relationships. The degree of pair correlation between financial indicators according to the Cheddock scale was considered high in case when the value of the correlation coefficient had reached 0.7. Subjects of analytical evaluation can make changes in the significance criterion indicator value being guided by their professional judgment, if necessary. The quantitative assessment informs us of the number of significant correlation relationships of financial indicators inside and outside their group. Thus, the quantitative characteristics of correlation relationships indicate that the financial indicators of the profitability group are on average closely interrelated with the six indicators, while the indicators of solvency and turnover groups have close interrelations with only one or two indicators from their group. The closest out-group interrelation is observed for the profitability group indicators, on the average, the indicators of this group closely correlate with the nine or ten financial indicators of the thirty ones calculated in the analysis. The data presented in Table 2 allows to determine the correlation between an individual indicator and the group of financial indicators. The most significant correlation relationships are observed for the following indicators: the ratio of accounts receivable and accounts payable, profitability of total assets, return on equity, accounting profitability, operating profitability, and net profit margin. A qualitative characteristic shows an average estimate of the strength of the relationship between intra-group and out-group correlation relationships of individual performance indicators for the company. The calculation of the average coefficient of pair correlation by groups, as well as within the whole array of financial ratios, was carried out according to the following formula:

$$\text{---} \quad (1)$$

Where:  $R_{avgj}$  - average group coefficient of pair correlation in group j;  
 – the sum of the pair correlation coefficients in group j;  
 $n_j$  - the number of indicators in group j.

Table 1 The calculation results for financial indicators of PJSC "Oil Company "Lukoil" for 2007-2015

Financial indicators / Year	2015	2014	2013	2012	2011	2010	2009	2008	2007
I. 1. Debt-to-assets ratio	.36	.32	.27	.26	.27	.29	.29	.29	.30
2. Ratio of long-term capital to property, plant and equipment	.26	.23	.24	.34	.37	.33	.26	.24	.30
3. Equity-to-assets ratio	.64	.67	.73	.74	.72	.71	.71	.70	.69
4. Debt-to-equity ratio	.56	.48	.37	.34	.38	.41	.41	.42	.44
5. Current assets to equity ratio	0.17	0.14	0.07	0.01	0.03	0.08	0.10	0.07	0.03
6. Current assets to inventory ratio	1.54	1.25	0.68	0.09	0.30	0.80	1.16	0.80	0.31
7. Ratio of current assets to total assets	.25	.23	.22	.25	.25	.24	.22	.25	.29
8. Long-term financing structure ratio	.24	.21	.17	.15	.17	.19	.18	.16	.18
9. Ratio of equity and long-term liabilities to total assets	.85	.86	.88	.87	.87	.87	.86	.84	.84
II. 1. Current ratio	.66	.65	.86	.03	.02	.88	.65	.63	.88
2. Quick ratio	.20	.13	.19	.37	.39	.31	.20	.22	.40
3. Absolute liquidity ratio	.31	.20	.19	.26	.25	.24	.25	.19	.10
4. Times interest earned ratio	.83	0.84	2.43	6.51	9.90	7.11	4.59	3.47	0.09
5. Ratio of accounts receivable to accounts payable	.17	.19	.16	.33	.46	.43	.36	.51	.86
III. 1. Total assets turnover	.06	.12	.17	.19	.31	.06	.92	.42	.21
2. Current assets turnover	.22	.78	.32	.73	.18	.49	.12	.67	.16
3. Inventory turnover ratio	.31	.18	.25	.16	.35	.37	.57	.14	.49
4. Payables turnover ratio	.93	.92	.06	.99	.16	.11	.08	.34	.09

5. Receivables turnover ratio	.17 <sup>9</sup>	.88 <sup>9</sup>	0.79 <sup>1</sup>	.28 <sup>9</sup>	.82 <sup>9</sup>	.37 <sup>8</sup>	.61 <sup>7</sup>	.43 <sup>9</sup>	.38 <sup>6</sup>
6. Equity turnover	.65 <sup>1</sup>	.65 <sup>1</sup>	.60 <sup>1</sup>	.61 <sup>1</sup>	.80 <sup>1</sup>	.50 <sup>1</sup>	.30 <sup>1</sup>	.04 <sup>2</sup>	.76 <sup>1</sup>
7. Property, plant and equipment turnover	.58 <sup>1</sup>	.61 <sup>1</sup>	.65 <sup>1</sup>	.83 <sup>1</sup>	.05 <sup>2</sup>	.62 <sup>1</sup>	.35 <sup>1</sup>	.11 <sup>2</sup>	.88 <sup>1</sup>
8. Cash and cash equivalent turnover	4.27 <sup>2</sup>	4.29 <sup>4</sup>	9.26 <sup>5</sup>	9.89 <sup>3</sup>	4.62 <sup>4</sup>	7.23 <sup>3</sup>	0.58 <sup>3</sup>	8.70 <sup>5</sup>	1.58 <sup>8</sup>
IV. 1. Ratio of return on total assets	.07 <sup>0</sup>	.10 <sup>0</sup>	.08 <sup>0</sup>	.12 <sup>0</sup>	.13 <sup>0</sup>	.12 <sup>0</sup>	.10 <sup>0</sup>	.16 <sup>0</sup>	.18 <sup>0</sup>
2. Ratio of return on shareholders' equity	.09 <sup>0</sup>	.14 <sup>0</sup>	.11 <sup>0</sup>	.15 <sup>0</sup>	.17 <sup>0</sup>	.16 <sup>0</sup>	.13 <sup>0</sup>	.22 <sup>0</sup>	.25 <sup>0</sup>
3. Earnings per share (EPS), rub	08.36 <sup>4</sup>	54.79 <sup>5</sup>	39.74 <sup>3</sup>	39.45 <sup>4</sup>	28.26 <sup>4</sup>	33.76 <sup>3</sup>	50.41 <sup>2</sup>	19.78 <sup>3</sup>	81.88 <sup>2</sup>
4. Operating margin	.09 <sup>0</sup>	.09 <sup>0</sup>	.09 <sup>0</sup>	.12 <sup>0</sup>	.12 <sup>0</sup>	.13 <sup>0</sup>	.14 <sup>0</sup>	.16 <sup>0</sup>	.20 <sup>0</sup>
5. Accounting margin	.08 <sup>0</sup>	.10 <sup>0</sup>	.09 <sup>0</sup>	.12 <sup>0</sup>	.12 <sup>0</sup>	.13 <sup>0</sup>	.13 <sup>0</sup>	.15 <sup>0</sup>	.19 <sup>0</sup>
6. EBITDA margin	.15 <sup>0</sup>	.17 <sup>0</sup>	.14 <sup>0</sup>	.16 <sup>0</sup>	.17 <sup>0</sup>	.19 <sup>0</sup>	.20 <sup>0</sup>	.18 <sup>0</sup>	.23 <sup>0</sup>
7. Net income margin	.06 <sup>0</sup>	.08 <sup>0</sup>	.07 <sup>0</sup>	.09 <sup>0</sup>	.09 <sup>0</sup>	.10 <sup>0</sup>	.10 <sup>0</sup>	.11 <sup>0</sup>	.14 <sup>0</sup>
8. OIBDA margin	.16 <sup>0</sup>	.15 <sup>0</sup>	.13 <sup>0</sup>	.16 <sup>0</sup>	.16 <sup>0</sup>	.18 <sup>0</sup>	.20 <sup>0</sup>	.19 <sup>0</sup>	.23 <sup>0</sup>

Table 2 Quantitative and qualitative characteristics of correlation interrelationships for financial indicators of PJSC "Oil company "Lukoil"

Financial indicator	Quantitative assessment					Qualitative assessment					
	Group				total	Group				Average	
<b>I. Financial soundness indicators</b>											
1. Debt-to-assets ratio						.72	.34	.23	.17	.37	0
2. Ratio of long-term capital to property, plant and equipment						.49	.46	.16	.19	.31	0
3. Equity-to-assets ratio						.73	.31	.23	.14	.36	0
4. Debt-to-equity ratio						.72	.34	.23	.18	.37	0
5. Current assets to equity ratio						.71	.64	.35	.45	.53	0
6. Current assets to inventory ratio						.69	.65	.34	.38	.50	0
7. Ratio of current assets to total assets						.30	.57	.40	.58	.45	0
8. Long-term financing structure ratio						.65	.46	.34	.38	.46	0
9. Ratio of equity and long-term liabilities to total assets						.47	.42	.34	.48	.43	0
<b>II. Solvency ratios</b>											
1. Current ratio						.66	.34	.18	.13	.34	0
2. Quick ratio						.57	.54	.28	.49	.46	0
3. Absolute liquidity ratio						.29	.43	.39	.60	.42	0
4. Times interest earned ratio						.43	.57	.53	.65	.54	0
5. Ratio of accounts receivable to accounts payable					1	.39	.59	.47	.87	.57	0
<b>III. Turnover ratios</b>											
III. 1. Total assets turnover						.34	.40	.67	.25	.40	0
2. Current assets turnover						.30	.15	.57	.24	.32	0
3. Inventory turnover ratio						.17	.33	.44	.51	.36	0
4. Payables turnover ratio						.33	.31	.53	.50	.42	0
5. Receivables turnover ratio						.22	.37	.28	.74	.40	0
6. Equity turnover						.21	.30	.61	.24	.33	0
7. Property, plant and equipment turnover						.41	.48	.61	.33	.45	0
8. Cash and cash equivalent turnover						.35	.61	.40	.56	.47	0
<b>IV. Profitability ratios</b>											
1. Ratio of return on total assets					1	.45	.67	.55	.80	.60	0
2. Ratio of return on shareholders' equity					1	.40	.66	.54	.80	.58	0

3. Earnings per share (EPS)						.19	.26	.32	.50	.31	0
4. Operating margin						.35	.58	.45	.89	.55	0
5. Accounting margin				0		.38	.63	.43	.89	.56	0
6. EBITDA margin						.22	.49	.33	.83	.45	0
7. Net income margin						.40	.62	.39	.86	.55	0
8. OIBDA margin						.24	.48	.36	.84	.46	0

In most cases, the average coefficient of pair correlation calculated for the group is more significant than upon determining the complex correlation of a particular indicator with the whole array of financial indicators what explains the logic of the separation of indicators between groups. The profitability group indicators demonstrate the highest group and complex interrelation in comparison with other analytical coefficients. The average correlation in the group is 0.84. The indicators of the remaining groups show approximately the same degree of intragroup correlation the value of which varies within 0.49-0.61. When conducting a comparative analysis of the out-group correlations between the financial ratios of the analyzed groups, a significant variation was observed. The average value of the out-group correlation is low and makes 0.41. The greatest degree of correlation which amounts to 0.55 is characteristic for financial indicators of solvency and profitability groups.

Analyzing the results of qualitative and quantitative evaluation of correlation relationships, we have revealed that some subgroups of indicators have almost identical characteristics, namely: intra-group relationship; intergroup relationship; the number of indicators with which the evaluation object correlates inside and outside its group; and the strength of relationship. In Figure 1, subgroups of indicators with the same quantitative and qualitative characteristics are systematized. A table is presented for each subgroup of indicators the first line of which contains the average data characterizing the quantitative assessment, and the second one contains a qualitative assessment of the correlation relationships.

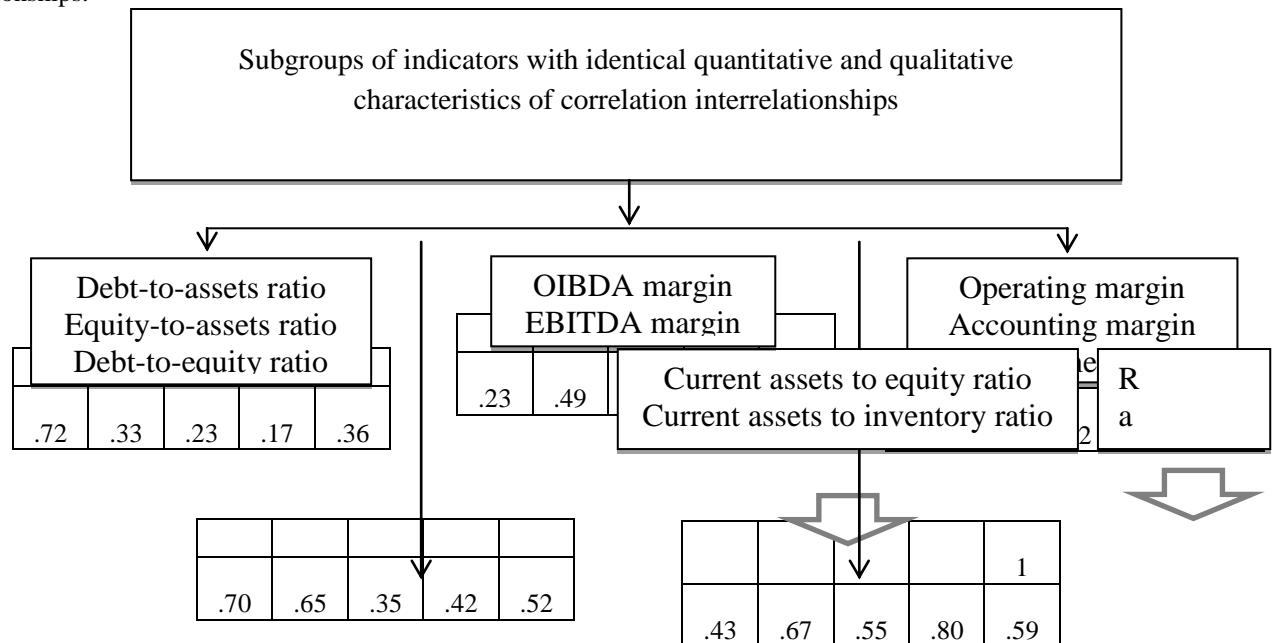


Fig. 1. Subgroups of indicators that have identical quantitative and qualitative characteristics of correlation interrelationships

**4. Conclusions**

Thus, the high level of strength of relationships for the above-mentioned financial ratios allows us to reasonably cut the composition of the indicators used in the comprehensive assessment of the financial standing of a company, or establish a decreasing significance factor for some indicators of the identified subgroups in constructing an integrated system of indicators characterizing the financial standing and main results of the financial and economic activities.

**5. Summary**

We have proposed the algorithm for compiling a system of economic indicators based on construction of a correlation matrix and identification of quantitative and qualitative characteristics of the correlation interrelationships of

indicators that helps to increase the effectiveness of procedures for an integrated assessment of the financial position of a company. The conducted research has formed the basis for the argumentation that it is inexpedient to form a universal system of indicators which is optimal for use upon conducting a financial analysis of various economic entities. In our opinion, the composition of indicators which are used in the financial analysis process should be compiled and reviewed for each economic entity individually taking into account the characteristics of correlation relationships of its financial position indicators and the results of financial and economic activities.

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